PRICE $1.00

Assembling and Using Your...

Heathkit

UTILITY POWER SUPPLY

MODEL UT-1

HEATH COMPANY

A Subsidiary of Daystrom Inc.

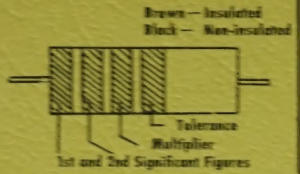
BENTON HARBOR, MICHIGAN

595-271

STANDARD COLOR CODE — RESISTORS AND CAPACITORS

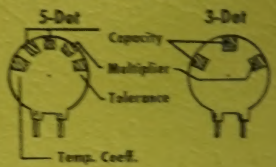
INSULATED UNINSULATED Color	FIRST RING BODY COLOR First Figure	SECOND RING END COLOR Second Figure	THIRD RING DOT COLOR Multiplier
BLACK	0	0	None
BROWN	1	1	0
RED	2	2	00
ORANGE	3	3	,000
YELLOW	4	4	0,000
GREEN	5	5	00,000
BLUE	6	6	000,000
VIOLET	7	7	0,000,000
GRAY	8	8	00,000,000
WHITE	9	9	000,000,000

AXIAL LEAD RESISTOR

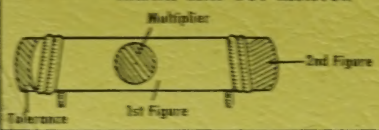


Wire wound resistors have 1st digit band double width

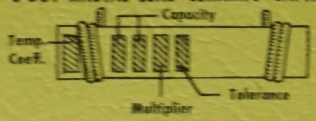
DISC CERAMIC RMA CODE



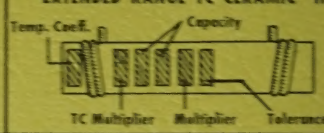
RADIAL LEAD DOT RESISTOR



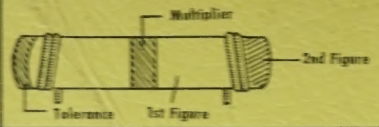
5-DOT RADIAL LEAD CERAMIC CAPACITOR



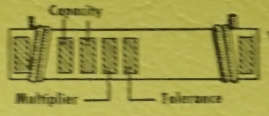
EXTENDED RANGE TC CERAMIC HICAP



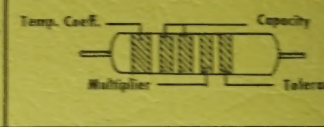
RADIAL LEAD (BAND) RESISTOR



BY-PASS COUPLING CERAMIC CAPACITOR



AXIAL LEAD CERAMIC CAPACITOR

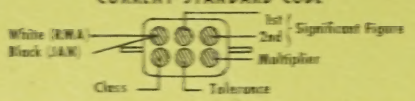


The standard color code provides all necessary information required to properly identify color coded resistors and capacitors. Refer to the color code for numerical values and the zeroes or multipliers assigned to the colors used. A fourth color band on resistors determines tolerance rating as follows: Gold = 5%, silver = 10%. Absence of the fourth band indicates a 20% tolerance rating.

The physical size of carbon resistors is determined by their wattage rating. Carbon resistors most commonly used in Heathkits are ½ watt. Higher wattage rated resistors when specified are progressively larger in physical size. Small wire wound resistors ½ watt, 1 or 2 watt may be color coded but the first band will be double width.

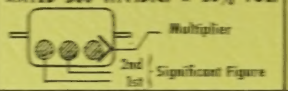
MOLDED MICA TYPE CAPACITORS

CURRENT STANDARD CODE



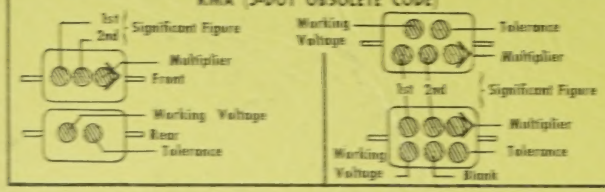
JAN & 1948 RMA CODE

RMA 3-DOT (OBSOLETE) RATED 500 W.V.D.C. ± 20% TOL.

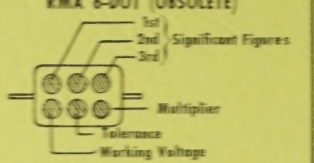


BUTTON SILVER MICA CAPACITOR

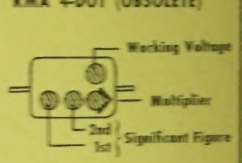
RMA (5-DOT OBSOLETE CODE)



RMA 6-DOT (OBSOLETE)

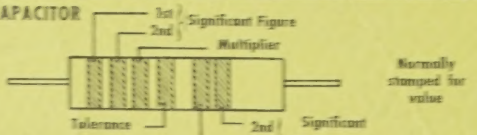


RMA 4-DOT (OBSOLETE)



MOLDED PAPER TYPE CAPACITORS

TUBULAR CAPACITOR

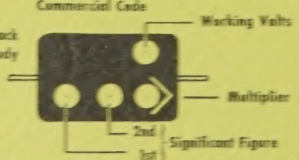


Normally stamped for value

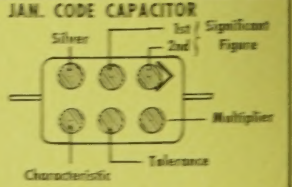
A 2 digit voltage rating indicates more than 900 V. Add 2 zeros to end of 2 digit number.

MOLDED FLAT CAPACITOR

Commercial Code



JAN. CODE CAPACITOR



The tolerance rating of capacitors is determined by the color code. For example: red = 2%, green = 5%, etc. The voltage rating of capacitors is obtained by multiplying the color value by 100. For example: orange = 3 × 100 or 300 volts. Blue = 6 × 100 or 600 volts.

In the design of Heathkits, the temperature coefficient of ceramic or mica capacitors is not generally a critical factor and therefore Heathkit manuals avoid reference to temperature coefficient specifications.

ASSEMBLY AND OPERATION OF THE HEATHKIT UTILITY POWER SUPPLY

MODEL UT-1

SPECIFICATIONS

Power Requirements:	117 volts AC, 50 to 60 cycles, 200 watts.
Chassis Dimensions:	9" long, 4 3/4" wide, 2 1/4" high.
Overall Height:	6" (with cover and four rubber feet).
Total DC Output Power:	1. 150 watts - 600 volts at 250 milliamperes or 2. 150 watts - 600 volts at 200 milliamperes and 300 volts at 100 milliamperes.
Filament Power:	6.3 volts at 8 amperes, or 12.6 volts at 4 amperes
Regulation (50% load to 100% load, from high voltage tap):	Approximately 10%.
Ripple Content:	Less than 1%.
Net Weight:	12 lbs.
Shipping Weight:	15 lbs.

7-17-59

INTRODUCTION

The Heathkit Model UT-1 Utility Power Supply was designed primarily to furnish all the necessary power for the Heath Mobile Transmitter and Receiver, when they are used as fixed station units.

Being a utility power supply allows it to be used to supply power to many other makes and types of amateur equipment as well.

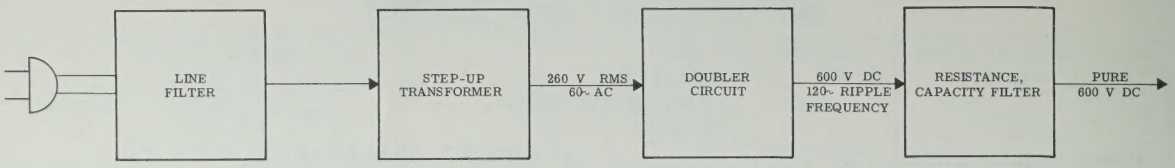
The Model UT-1 will supply a full 150 watts of power, 600 volts at 250 milliamperes. A half voltage tap (300 volts) is available for supplying the receiver, or low level stages of the transmitter.

The loads on the high and low voltage terminals of the supply should be adjusted so that the total power drain will not exceed the 150 watts. A typical example would be a drain of 600 volts at 200 milliamperes from the high voltage tap which equals 120 watts. This would leave 30 watts available at the low voltage tap, or 300 volts at 100 milliamperes. The total of the two will equal the 150 watt rating of the supply.

In event of a complete short circuit of either one of the outputs of the supply, two fuses of the proper current rating afford adequate protection.

The supply features excellent static regulation combined with the advantages of good dynamic regulation achieved through the use of high value filter capacitors.

A full-wave voltage doubler circuit affords good efficiency along with circuit economy. The resultant ripple frequency is twice the source frequency and therefore is easily filtered. A further advantage is that each capacitor in the doubler circuit requires a DC rating of only half the output voltage, since the capacitors are in series.



THEORY OF OPERATION

The conventional voltage doubler circuit used in this power supply has been chosen because of its efficiency, economy, and circuit simplicity.

A voltage doubler circuit will deliver a DC output voltage approximately twice the RMS value of the secondary winding of the transformer. Under very high current drains, the output voltage may be slightly under twice the secondary voltage.

In operation, the filter capacitors C5 and C6 are each charged to the peak voltage of the transformer secondary on alternate half cycles, but with polarities such that the DC voltages developed across the capacitors add, in so far as the output voltage is concerned.

Due to the very low ripple content existing in the waveform immediately after rectification (the ripple frequency being doubled, as well as the voltage), a minimum of filtering is required. This is accomplished with a simple resistance and capacity network, consisting of R1 and R2 and C7 and C8.

In order to maintain regulation during instantaneous peaks of current drain, high value output filter capacitors are used.

PROPER SOLDERING TECHNIQUES

Only a small percentage of Heathkit purchasers find it necessary to return an instrument for factory service. Of these instruments, by far the largest proportion of malfunctions are due to poor or improper soldering.

If terminals are bright and clean and free of wax, frayed insulation and other foreign substances, no difficulty will be experienced in soldering. Correctly soldered connections are essential if the performance engineered into a kit is to be fully realized. If you are a beginner with no experience in soldering, a half hour's practice with some odd lengths of wire may be a worthwhile investment.

For most wiring, a 30 to 100 watt iron or its equivalent in a soldering gun is very satisfactory. A lower wattage iron than this may not heat the connection sufficiently to allow the solder to flow smoothly over the joint. Keep the iron tip clean and bright by wiping it from time to time with a cloth.

CHASSIS WIRING AND SOLDERING

1. Unless otherwise indicated, all wire used is the type with the colored insulation (hookup wire); the size of the conductor is the same for all colors of hookup wire furnished with your kit. In the case that bare wire is to be covered with insulating sleeving, the phrase "use sleeving" will be used.

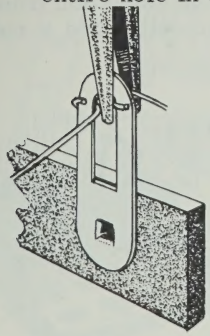
2. Leads on resistors, capacitors and transformers are sometimes much longer than they need to be to make the indicated connections. In these cases, the excess leads should be cut as prescribed before the part is added to the chassis. In general, the leads should be just long enough to reach their terminating points. Wherever there is a possibility of bare leads shorting to other parts or to the chassis, the leads should be covered with insulating sleeving.

3. Crimp or bend the lead (or leads) around the terminal to form a good joint without relying on solder for physical strength. If the wire is too large to allow bending, position the wire tight against or through the terminal so that a good solder connection can still be made.

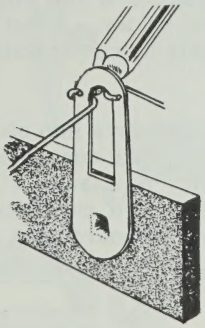
4. Position the work, if possible, so that gravity will tend to keep the solder where you want it.

5. Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.

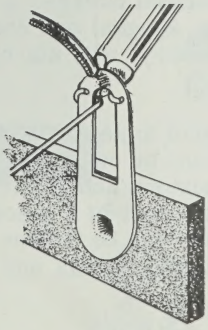
6. Place the solder against the heated terminal and it should immediately flow over the joint; use only enough solder to thoroughly wet the junction. It is usually not necessary to fill the entire hole in the terminal with solder.



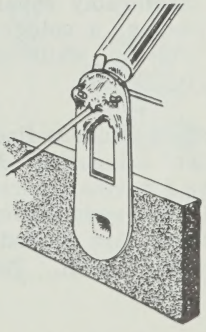
CRIMP WIRES



HEAT CONNECTION

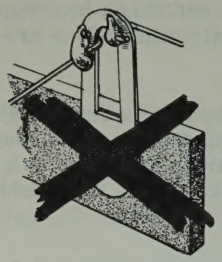


APPLY SOLDER

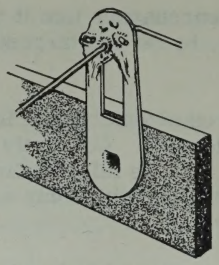


ALLOW SOLDER TO FLOW

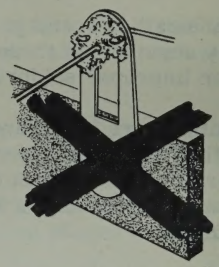
7. Remove the solder and then the iron from the completed junction. Use care not to move the leads until the solder is solidified.



COLD SOLDER JOINT CONNECTION INSUFFICIENTLY HEATED



PROPER SOLDER CONNECTION



COLD SOLDER JOINT CONNECTION MOVED WHILE COOLING

A poor or cold solder joint will usually look crystalline and have a grainy texture, or the solder will stand up in a blob and will not have adhered to the joint. Such joints should be reheated until the solder flows smoothly over the entire junction. In some cases, it may be necessary to add a little more solder to achieve a smooth, bright appearance.

NOTE: ALL GUARANTEES ARE VOIDED AND WE WILL NOT REPAIR OR SERVICE INSTRUMENTS IN WHICH ACID CORE SOLDER OR PASTE FLUXES HAVE BEEN USED. WHEN IN DOUBT ABOUT SOLDER, IT IS RECOMMENDED THAT A NEW ROLL PLAINLY MARKED "ROSIN CORE RADIO SOLDER" BE PURCHASED.

We suggest that you do the following before work is started:

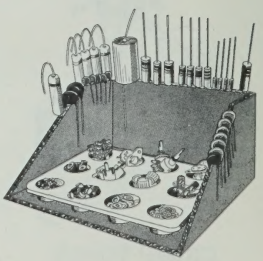
1. Attach the large fold-in pictorials to the wall above your work bench.

2. Read several steps ahead of the actual step being performed. This will familiarize you with the relationship of the subsequent operations.

3. Lay out all parts so that they are readily available.

4. Provide yourself with good quality tools. Basic tool requirements consist of a screwdriver with a 1/4" blade; a small screwdriver with a 1/8" blade; long-nose pliers; wire cutters, preferably separate diagonal cutters; a pen knife or a tool for stripping insulation from wires; a soldering iron (or gun) and rosin core solder. A set of nut drivers and a nut starter, while not necessary, will aid extensively in construction of the kit.

Most kit builders find it helpful to separate the various parts into convenient categories. Muffin tins or molded egg cartons make convenient trays for small parts. Resistors and capacitors may be placed with their lead ends inserted in the edge of a piece of corrugated cardboard until they are needed. Values can be written on the cardboard next to each component. The illustration shows one method that may be used.



STEP-BY-STEP PROCEDURE

The following instructions are presented in a logical step-by-step sequence to enable you to complete your kit with the least possible confusion. Be sure to read each step all the way through before beginning. When the step is completed, check it off in the space provided. This is particularly important as it may prevent errors or omissions, especially if your work is interrupted. Some kit builders have found it helpful to mark each lead in colored pencil on the pictorial as it is added.

The abbreviation "NS" indicates that a connection should not be soldered as yet for other wires may need to be added. When the last wire is installed, the terminal should be soldered and the abbreviation "S" is used to indicate this. Note that a number will appear after each solder instruction. This number indicates the number of leads that are supposed to be connected to the terminal in question before it is soldered. For example, if the instruction reads, "Connect one lead of a 47 KΩ resistor to lug 1 (S-2)", it will be understood that there will be two leads connected to the terminal at the time it is soldered. This additional check will help avoid errors.

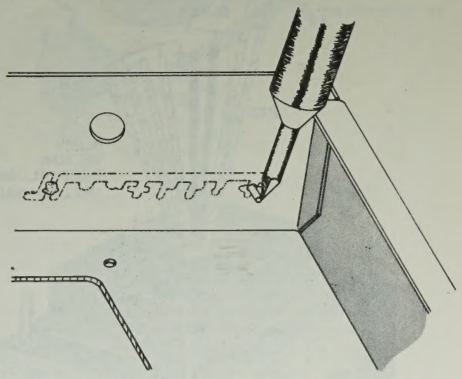
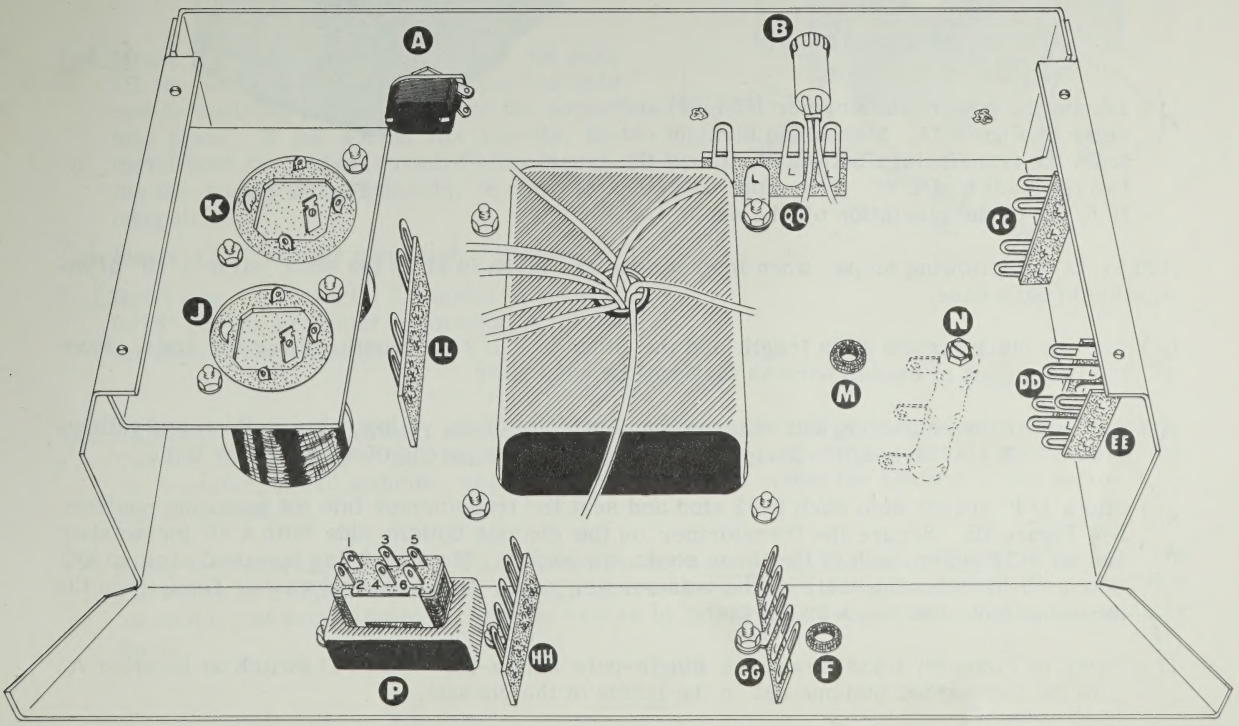


Figure 1

STEP-BY-STEP INSTRUCTIONS

( ) Referring to Figure 1, insert the two studs of the Heathkit nameplate in the two holes in the chassis face side, orienting as shown. While holding the nameplate tight to the chassis, melt the studs down with a hot soldering iron until a small flat retaining bead is formed.

( ) Referring to Pictorial 1, mount a 4-lug terminal strip at location CC. Orient the terminal strip as shown. Use a 6-32 x 1/4" Binder Head Machine Screw (BHMS) through the chassis, the mounting foot of the terminal strip, a #6 lockwasher, and secure with a 6-32 nut.



Pictorial 1

NOTE: The plastic nut holder will be found convenient in the mounting of these components.

( ) Mount a 4-lug terminal strip at location DD and a 2-lug terminal strip at location EE (on the same screw). Face the terminal strips as shown in Pictorial 1 and Figure 4A. Use a 6-32 x 1/4" BHMS through the chassis, the two mounting feet, a #6 lockwasher, and secure with a 6-32 nut.

( ) Mount a third 4-lug terminal strip at location LL, as shown. Use a 6-32 x 1/4" BHMS, #6 lockwasher and 6-32 nut.

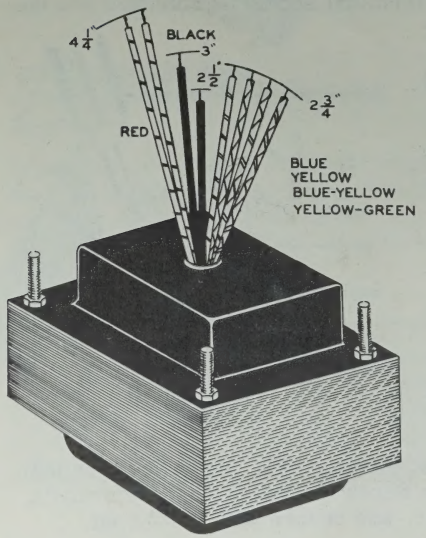


Figure 1A

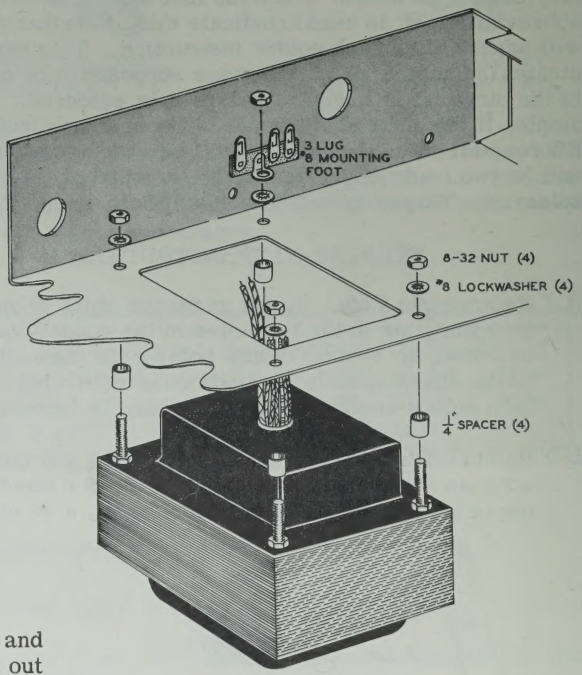


Figure 1B

( ) Locate the power transformer (#54-88) and refer to Figure 1A. Measuring straight out from the transformer bottom shell, cut the two red leads to 4 1/4". Trim approximately 5/16" of the insulation off the ends.

NOTE: In the following steps, when instructions are given to strip the ends, strip 5/16" of insulation in each case.

( ) Cut one black lead to 3" in length and the other to 2 1/2" in length. Strip the ends. Save the two pieces of excess wire as they will be used later.

( ) Cut each of the remaining four colored filament leads (blue, yellow, blue-yellow, and yellow-green) to 2 3/4" in length. Strip the ends. Save these pieces of wire for use later.

( ) Slip a 1/4" spacer onto each 8-32 stud and seat the transformer into its mounting position. See Figure 1B. Secure the transformer on the chassis bottom side with a #8 lockwasher and an 8-32 nut on each of the three studs, as shown. Mount a 3-lug terminal strip at QQ (has an 8-32 mounting foot) on the transformer stud. Use a #8 lockwasher first, then the mounting foot, and the 8-32 nut last.

( ) Refer to Pictorial 1 and mount the single-pole single-throw (SPST) switch at location A, with the lockwasher and one nut on the inside of the chassis.

( ) Scrape or sandpaper any paint from around the holes at locations GG and HH on the inside of the chassis. Mount a 5-lug terminal strip at location GG, using a 6-32 x 1/4" BHMS, #6 lockwasher between the chassis and the mounting foot, and secure with a 6-32 nut. Orient the strips as shown in Pictorial 1.

( ) Mount a second 5-lug terminal strip at location HH. At the same time, mount the male 6-contact (deep bracket) plug at location P, using 6-32 x 1/4" BHMS, #6 lockwashers and 6-32 nuts. The #6 lockwasher is used between the chassis and the mounting foot of terminal strip HH. Orient the plug with the numbered terminals as shown in Pictorial 1.

( ) Mount the two fiber mounting wafers on the top side of the electrolytic capacitor bracket, using 6-32 x 1/4" BHMS, #6 lockwashers and 6-32 nuts, as shown in Figure 1C.

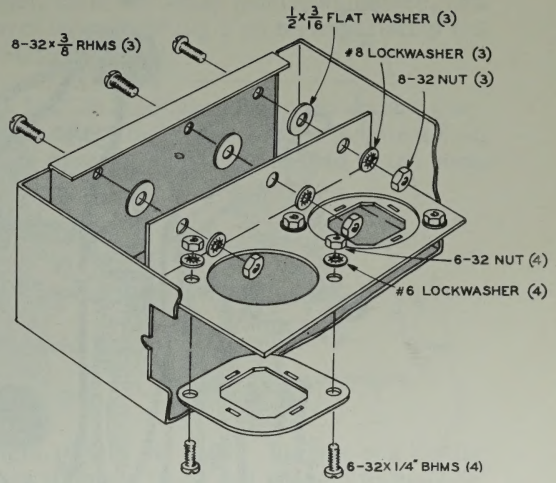


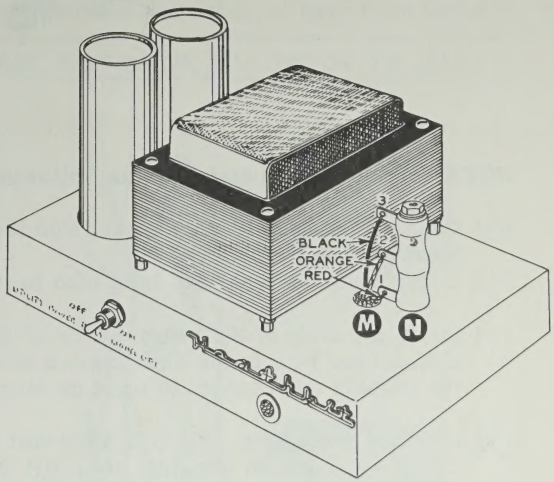
Figure 1C

( ) Secure this bracket to the end of the chassis at the 3-hole location; use an 8-32 x 3/8" screw through the chassis, a #8 flat washer, the bracket, a #8 lockwasher and secure with an 8-32 nut. See Pictorial 1 and Figure 1C.

( ) Mount the pilot light at location B. Be sure all the metal points are entering the hole before applying pressure to seat the socket into place. If the socket fits loosely, the metal tabs can be bent outward after inserting the socket in the chassis, to provide a snug fit.

( ) Mount a 3/8" rubber grommet at location F.

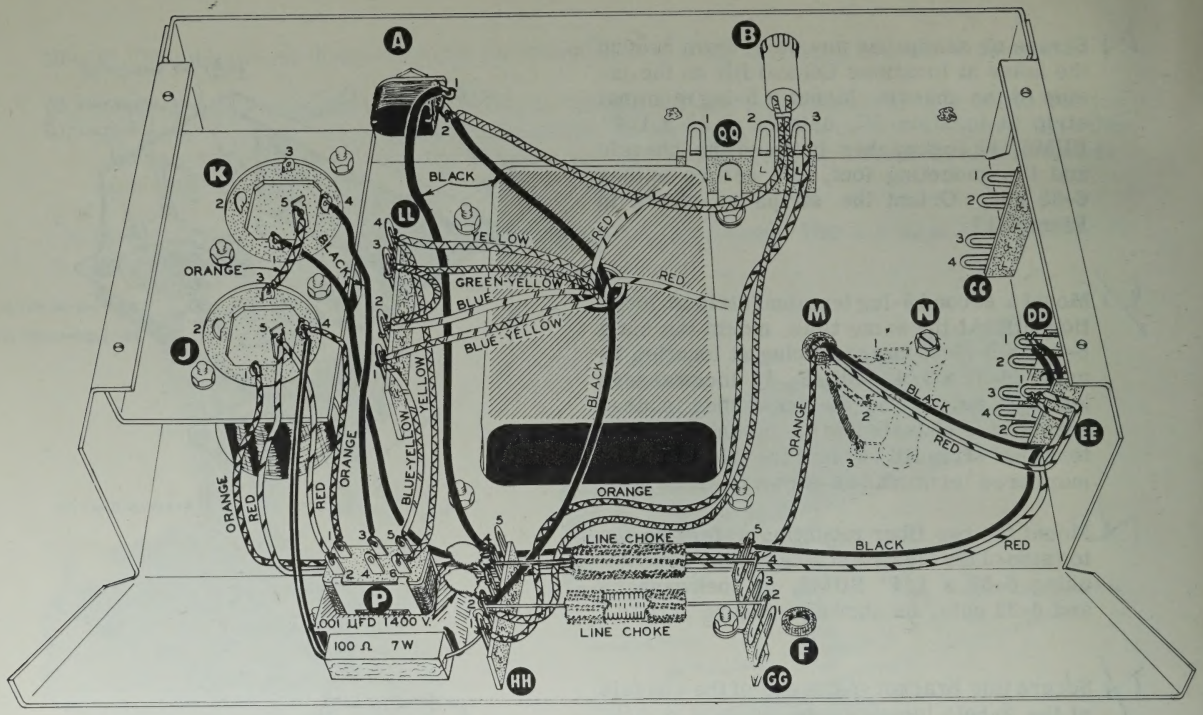
( ) Referring to Pictorial 2, mount a 3/16" x 5/16" rubber grommet at location M on the top side of the chassis.



Pictorial 2

( ) Adjacent to this grommet, at location N, mount the 30 KΩ 25 watt wire-wound resistor. Use the 10-24 x 2 1/4" hex head screw through the hole from the chassis bottom, through the resistor, a #10 shoulder washer (the shoulder fits inside the resistor), and secure with the 10-24 nut.

( ) Refer to Pictorial 1 on Page 5 and, from the top side of the chassis, insert the two 125 μfd 450 volt electrolytic capacitors through the two large holes J and K. Orient the capacitors as shown and secure them in the fiber wafers by twisting the four mounting tabs one-quarter turn.



Pictorial 3

NOTE: Refer to Pictorial 3 for the following steps unless otherwise specified.

( ) Connect the longer black lead from the transformer to terminal 2 on the SPST switch at location A (NS).

( ) Connect the nearest pilot light lead to the same terminal 2 on the SPST switch (S-2).

( ) Strip both ends of the longer piece of black wire which was trimmed off the transformer. Connect one lead to the SPST switch terminal 1 (S-1). Route the remaining lead down along the chassis and connect to lug 4 on terminal strip HH (NS).

( ) Cut both leads of a .001 μfd 1400 volt disc ceramic capacitor to 3/8" in length. Connect one end to lug 4 on terminal strip HH (NS). Connect the other end to lug 3 on terminal strip HH (NS).

( ) Cut both leads of a line choke to 5/8" in length. While retaining the end turns of the coil by holding them with narrow-nose pliers, bend both leads axially to facilitate mounting, as shown in Pictorial 3. Slip a piece of the large 3/8" sleeving over the choke coil. Connect one end to lug 4 on terminal strip GG (NS). Connect the other end to lug 4 on terminal strip HH (S-3). Trim off excess lead length.

( ) Connect the remaining black lead from the transformer to lug 2 on terminal strip HH (NS).

( ) Route the remaining pilot light lead under the line choke, as shown, and connect to the same lug 2 on terminal strip HH (NS).

( ) Cut the leads on another .001 μfd 1400 volt disc ceramic capacitor to 3/8" in length. Connect one end to lug 2 on terminal strip HH (NS). Connect the other end to lug 3 on terminal strip HH (S-2).

(X) Cut both leads on another line choke to 1/2" in length, form the leads axially as before, and slip a piece of 3/8" sleeving over the choke. Connect one end to lug 2 on terminal strip GG (NS). Connect the other end to lug 2 on terminal strip HH (S-4).

(X) Cut a piece of the remaining blue-yellow wire to 1 1/2" in length and strip the ends. Connect one end to lug 1 on terminal strip LL (NS). Connect the other end to terminal 5 on the power output socket (S-1). Use care in soldering to avoid shorting this lead to the socket frame.

(X) Connect the blue-yellow lead from the transformer to lug 1 on terminal strip LL (NS).

(X) Connect the blue lead from the transformer to lug 2 on terminal strip LL (NS).

(X) Connect the green-yellow lead to lug 3 on terminal strip LL (NS).

(X) Connect the yellow lead to lug 4 on terminal strip LL (NS).

( ) Cut a piece of the leftover yellow lead to 3" in length. Strip the ends. Tin one end lightly with solder and route this lead down under the other filament leads and connect to lug 4 on terminal strip LL (NS). Connect the remaining lead to terminal 6 on the power output socket (S-1). Do not allow a short between terminals at this point.

NOTE: Now decide whether this supply is to deliver 6.3 volts AC at 8 amperes or 12.6 volts AC at 4 amperes for the filament circuit. If the supply is to be used with the Heathkit Models MR-1 and MT-1, select the filament voltage for which the transmitter and receiver have been wired.

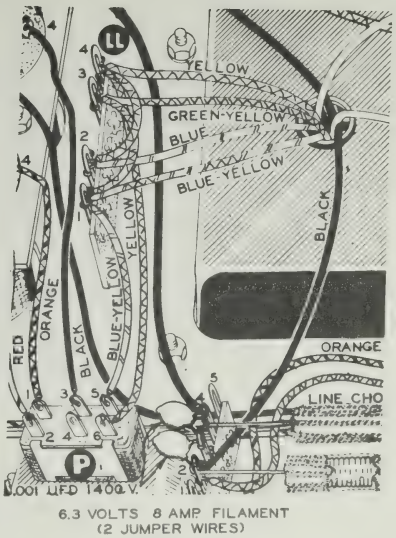
SELECT AND PERFORM THE STEPS FOR ONLY ONE, NOT BOTH, VALUES OF FILAMENT VOLTAGE.

FOR 6.3 VOLTS AT 8 AMPERES (See Figure 3A):

(X) Cut two pieces of the leftover blue and yellow-green leads to 2 1/2" in length. Strip the ends and tin lightly. Connect the yellow-green lead as a jumper from lug 1 on terminal strip LL (S-3) to lug 3 on LL (S-2).

(X) Connect the blue lead as a jumper from lug 2 on terminal strip LL (S-2) to lug 4 on terminal strip LL (S-3).

This completes the wiring for 6.3 volt filament operation.



6.3 VOLTS 8 AMP FILAMENT
(2 JUMPER WIRES)

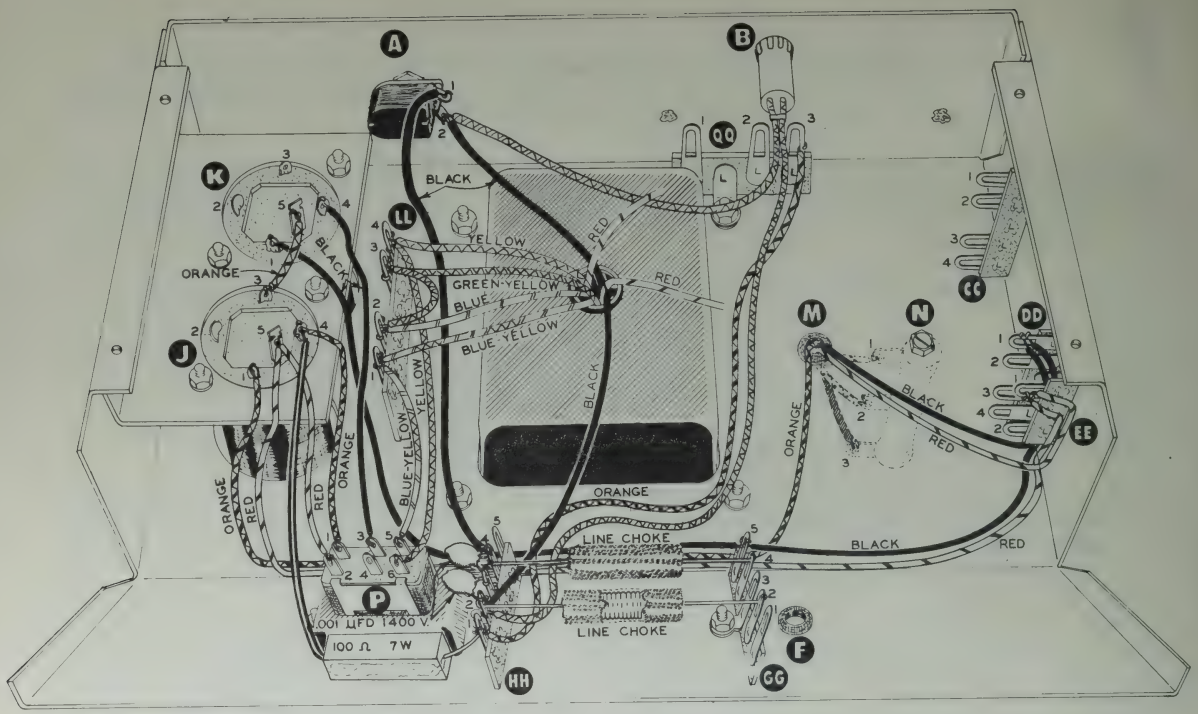
Figure 3A

FOR 12.6 VOLTS AT 4 AMPERES (See Pictorial 3):

( ) Cut one piece of the remaining blue lead to 2 1/2" in length. Strip the ends and tin lightly. Connect one lead to lug 2 on terminal strip LL (S-2). Connect the other lead to lug 3 on terminal strip LL (S-2).

( ) Solder lug 1 (S-2) and lug 4 (S-2) on terminal strip LL.

This completes the wiring for 12.6 volt filament operation.



Pictorial 3

( ) Cut a piece of black hookup wire 3" in length. Strip the ends. Connect one end to terminal 3 on the power output socket (S-1). Connect the other end to lug 4 on the 125 μfd capacitor at location K (S-1).

( ) Cut a piece of orange wire to 1 3/4" in length. Strip the ends. Connect one end to terminal 1 on the power output socket (S-1). Connect the other end to lug 4 on the 125 μfd capacitor at location J (NS).

( ) Cut one lead of a 100 Ω 7 watt resistor to 5/8" in length. Cover the other lead with a piece of insulated sleeving, 1 1/4" in length. Connect the short lead to lug 1 on terminal strip HH (NS). If the resistor supplied is the square body type, face the "filled" side of the resistor upward, or away from the power output socket, otherwise rest the resistor body against the socket. Connect the insulated lead to lug 4 on the 125 μfd capacitor at location J (S-2).

( ) Cut a piece of black hookup wire 6 1/2" in length. Strip the ends. Route one end down under the other wiring and connect to lug 5 on terminal strip GG (NS). Connect the other end to lug 1 on the 125 μfd capacitor at location K (S-1).

( ) Cut another piece of black wire 5 1/2" in length. Strip the ends. Connect one end to lug 5 on terminal strip GG (NS), routing close to the chassis. Connect the other end to lug 1 on terminal strip DD (NS).

( ) Cut another piece of black wire 6 1/2" in length. Strip the ends. Connect one end to terminal 3 of the 30 KΩ 25 watt bleeder resistor (S-1). Route the other end through grommet M close to the chassis and connect to lug 1 on terminal strip DD (NS).

( ) Cut a piece of orange wire 1 1/2" in length. Strip the ends. Connect one end to terminal 3 on the 125 μfd filter capacitor J (S-1). Connect the other end to terminal 5 on the 125 μfd filter capacitor K (S-1).

( ) Cut a piece of orange hookup wire 10" in length. Strip the ends. From the bottom side of the chassis, insert one end up through the 5/16" rubber grommet M adjacent to the 30 KΩ bleeder resistor, and connect to lug 2 on the bleeder resistor (S-1). Route the other lead end close to the chassis, under terminal strip GG and HH and connect to lug 1 on the 125 μfd filter capacitor at location J (S-1).

( ) Cut a piece of orange hookup wire 7 1/2" in length. Strip the ends. Route one end down under the line chokes, close to the chassis and connect to lug 3 on terminal strip QQ (NS) (lugs 1 and 2 are not used). Connect the other end to lug 1 on terminal strip HH (S-2).

( ) Cut a piece of red hookup wire 1 3/4" in length. Strip the ends. Connect one end to terminal 2 on the power output socket (S-1). Connect the other end to lug 5 on the 125 μfd filter capacitor J (NS).

( ) Cut another piece of red hookup wire 11" in length. Strip the ends. Route one end down close to the chassis, under the power output socket, under terminal strips HH and GG, and up to lug 1 on terminal strip EE (NS). Connect the other end to lug 5 on the 125 μfd filter capacitor J (S-2).

( ) Cut another piece of red hookup wire 5" in length. Strip the ends. From the chassis bottom side, insert one end up through the 5/16" rubber grommet M and connect to lug 1 on the bleeder resistor (S-1). Route the other end close to the chassis, and up to lug 1 on terminal strip EE (NS). Lug 2 is not used.

Refer to Pictorial 4 for the following steps, unless otherwise specified.

NOTE: Maintain the diode bodies at the midpoint between terminal strips CC and DD. Do not allow the diodes to touch the chassis or each other.

( ) Refer to Figure 4A for diode polarity indication. Cut the leads on each of the four diodes to 1" in length, measuring from the diode body, as shown. Mount the first diode with the positive (+) lead connected to lug 4 on terminal strip DD (NS). Connect the negative (-) lead to lug 4 on terminal strip CC (NS).

( ) In a similar manner, mount a second diode with the negative (-) end connected to lug 3 on terminal strip DD (NS) and the positive (+) end connected to lug 3 on terminal strip CC (NS).

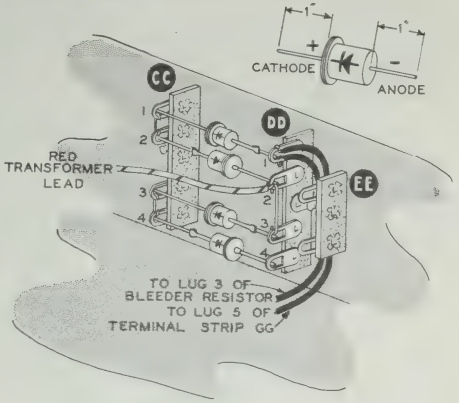


Figure 4A

( ) Connect a 1" length of bare wire (a clipping from one of the components) between lug 3 (S-2) and lug 4 (S-2) on terminal strip CC, as shown in Figure 4A.

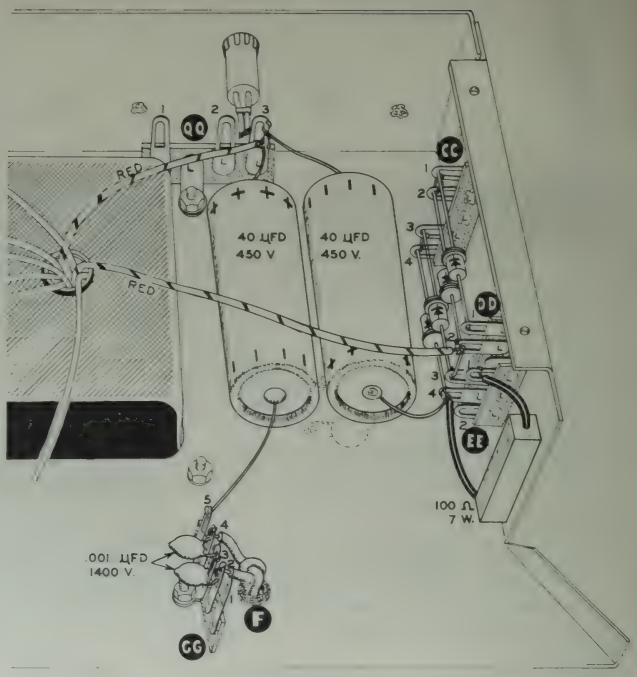
( ) Connect the positive end of a third diode to lug 2 on terminal strip DD (NS). Connect the negative lead of this same diode to lug 2 on terminal strip CC (NS).

( ) Install the fourth diode with its negative lead connected to lug 1 on terminal strip DD (S-3). Connect the positive lead of this same diode to lug 1 on terminal strip CC (NS).

( ) Connect a 1" length of bare wire between lug 1 (S-2) and lug 2 (S-2) of terminal strip CC, as shown in Figure 4A.

( ) Connect a 1 1/4" length of bare wire between lug 2 (NS) and lug 3 (S-2) on terminal strip DD.

( ) Cut one lead of a 100 Ω 7 watt resistor to 1 1/4" in length. Cover this lead with a piece of insulated sleeving 1" in length. Cover the longer lead with a piece of sleeving 1 1/4" in length.



Pictorial 4

( ) Place this resistor in the corner of the chassis, as shown. Connect the longer lead to lug 4 on terminal strip DD (NS). Connect the other lead to lug 1 on terminal strip EE (S-3).

( ) Place this resistor in the corner of the chassis, as shown in Pictorial 4. Connect the longer lead to lug 4 on terminal strip DD (NS). Connect the other lead to lug 1 on terminal strip EE (S-3).

( ) Cut both leads on a 40 μfd 450 volt filter capacitor to 1 1/4" in length. Position the capacitor as shown in Pictorial 4, allowing 1/8" to 1/4" of space between the capacitor and the transformer shell. Connect the positive (+) lead to lug 3 on terminal strip QQ (NS). Connect the negative (-) lead to lug 5 on terminal strip GG (S-3). Avoid burning the insulation on other adjacent wiring.

( ) Cut both leads on another 40 μfd filter capacitor to 1 1/2" in length. Connect the negative (-) lead to lug 3 on terminal strip QQ (NS). Connect the positive (+) lead to lug 4 on terminal strip DD (S-3).

( ) Connect the nearest red lead from the transformer to lug 2 on terminal strip DD (S-3).

( ) Connect the remaining red lead to lug 3 on terminal strip QQ (S-4).

( ) Separate the leads at one end of the line cord for a distance of 2". Strip the ends 1/4" and tin lightly with solder. Insert the prepared ends through the 3/8" rubber grommet F and tie a simple knot, as shown in Pictorial 4.

( ) Connect one lead of the line cord to lug 4 of terminal strip GG (NS). Connect the other lead to lug 2 on terminal strip GG (NS).

( ) Cut the leads on the two remaining .001 μfd 1400 volt disc ceramic capacitors to 3/8" in length. Connect one lead of one of these capacitors to lug 3 on terminal strip GG (NS). Connect the other lead to lug 4 on the same terminal strip (S-3).

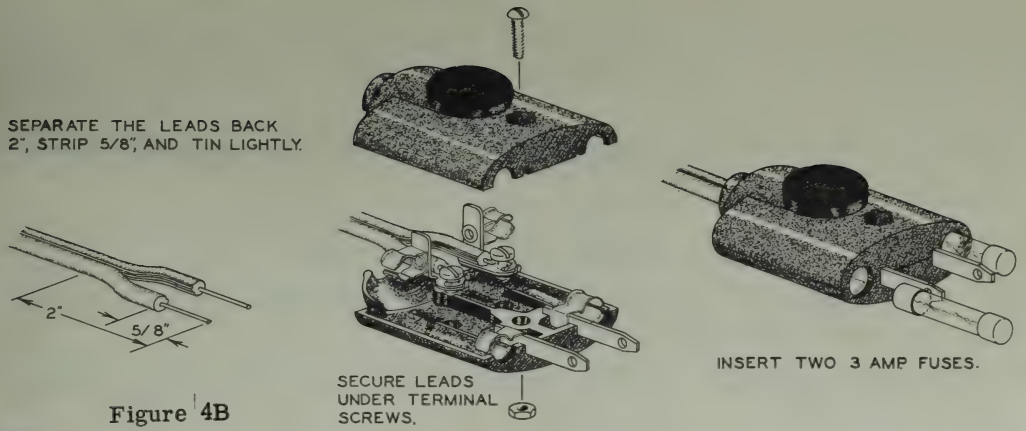


Figure 4B

( ) Connect one lead of the remaining .001 μfd disc capacitor to lug 2 on terminal strip GG (S-3). Connect the other lead to lug 3 on the same terminal strip (S-2).

( ) Refer to Figure 4B and mount the fused power plug on the free end of the line cord. Separate the two leads for 2". Strip the ends 5/8" and tin lightly with solder. Secure the two leads under the screw terminals of the plug. Insert the two 3 ampere fuses.

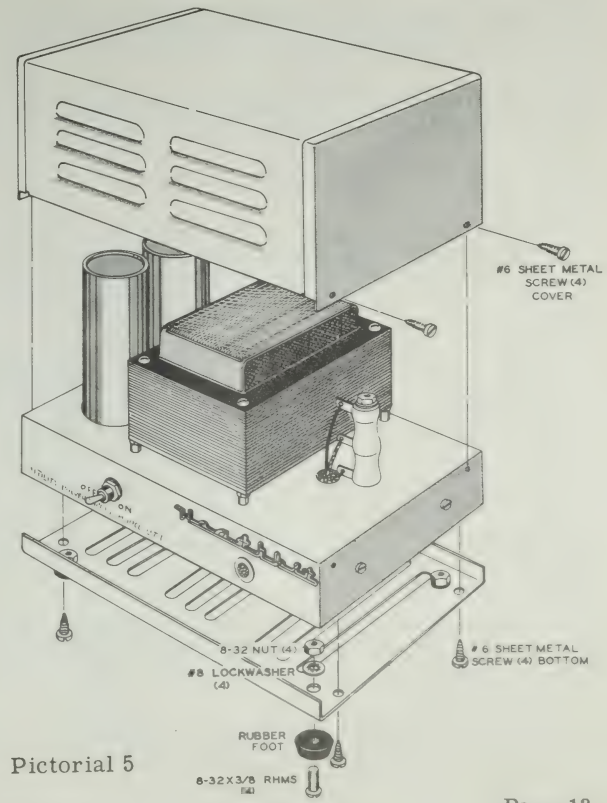
NOTE: The top and bottom chassis covers are mounted after testing the Supply.

TESTING THE UT-1 POWER SUPPLY

Be certain that the two 3 ampere fuses are in the power plug and insert the plug into a wall receptacle. Turn the power supply line switch to the ON position.

The pilot light should glow. (If it does not, see the IN CASE OF DIFFICULTY section on Page 15.) A point to point voltage check should be done before the Supply is used with any equipment. A high resistance voltmeter (generally 2000 to 20,000 ohms per volt) with at least 0-750 volt scale is used for voltage checking. A Heathkit Volt-Ohm-Milliammeter would be ideal. Measure from B-, which is terminal #3 on the power output socket, to the low voltage B+, which is terminal #1. The voltage should be approximately 365 volts with no load on the Supply other than the self contained bleeder resistor.

The voltage measured from B- terminal #3 to the high voltage terminal #2 on the power plug should be approximately 730 volts, with no load. These voltages drop to their rated values under proper load current. NOTE: A line voltage variation of more or less than 117 volts will reflect itself in slightly higher or lower readings of the Power Supply's output voltages.



Pictorial 5

On the low range "AC" scale of the test meter, the filament voltage measured from terminal #5 to #6 on the power output socket should read 6.3 volts or 12.6 volts, depending on which way the Supply was wired.

( ) Referring to Pictorial 5, mount the four rubber feet on the chassis bottom plate, as shown. Now mount both the bottom plate and top cover on the chassis, as shown. Place the adhesive label on one end of the top cover.

CABLE TO PLUG CONNECTION

NOTE: Place a power socket on each end of the power cable as follows, after cutting the cable to the minimum length required for your installation.

( ) Trim the outer insulating cover of the 8-conductor cable back 1". Strip the insulation from each colored lead 1/4".

( ) Using a narrow, pointed tool and a hammer, tap the retaining pin just about all the way out of the socket. Grasp with pliers and while twisting in a counterclockwise direction, withdraw the pin.

( ) Group the cable leads together and slip the 1" length of 1/4" insulating tubing over them. The plug cover is then slipped over the leads.

( ) Twist the strands tightly together in the same direction they already are. Insert the red lead through terminal 2 of the power plug. Bend half of the bared lead back on itself and pinch it together over the terminal (S-1).

( ) In the same manner, connect the green lead to terminal 4 (S-1).

( ) Twist the brown and blue leads together to form one common lead and connect to terminal 6 (S-1).

( ) Twist the yellow and white wires together to form one common lead and connect to terminal 5 (S-1).

( ) Connect the black lead to terminal 3 (S-1).

( ) Connect the orange lead to terminal 1 (S-1). Now reassemble the plug as shown in Figure 5.

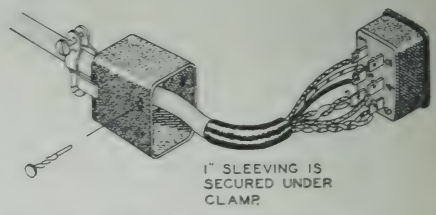


Figure 5

POWER CABLE CONNECTIONS

Fil.	-	Terminal #5	-	Yellow and white (together)
Fil.	-	Terminal #6	-	Brown and blue (together)
B+600V	-	Terminal #2	-	Red
B+300V	-	Terminal #1	-	Orange
B-	-	Terminal #3	-	Black
Relay	-	Terminal #4	-	Green

CAUTION: This may be an opportune time to caution the operator regarding possible electrocution.

The unloaded voltage of this supply can reach a very dangerous 700 volts with an instantaneous current value of well over the rating of 250 milliamperes. One must be mindful of not only the inherent regulation of the supply itself, but also the potential stored in the high value capacitors.

In a doubtful situation where electric shock is a possibility, the common practice of standing on some dry insulating material and working with one hand behind the back will add years to one's lifetime.

IN CASE OF DIFFICULTY

Upon completing your UT-1 Power Supply and plugging it into the line voltage source with the switch to the ON position, the neon pilot light should glow.

If it does not, use an alternating current voltmeter of proper voltage range (generally 0-150 volts AC) and check for line voltage at the pilot light terminals. (A test light could also be used.) If the line voltage does exist across the pilot light and it does not light, then the pilot light assembly is defective. If no line voltage is evident, remove the plug from the power source and use a VOM to check the fuses in the plug for continuity.

If the preceding checks fail to reveal the difficulty, a complete primary circuit check (including all solder connections) would be in order.

NOTE: Sometimes having a friend check your wiring may disclose an error consistently overlooked.

If the line fuses blow, a short circuit in either the primary or secondary circuit may exist. With the line plug removed, a resistance check between pins 2 and 3 of the output socket should give a reading near 30,000 Ω depending on the ohm-meter polarity. A reading of near zero ohms would indicate a short in the secondary circuit.

Little or no voltage at either the low or the high voltage terminals of the supply may indicate an open 100 Ω 7 watt resistor, a shorted electrolytic capacitor or one or more of the four diodes having become shorted. A transformer failure should not be overlooked. The primary and secondary should be checked for continuity.

Too heavy a load, or a direct short at either the high or low output of the supply (if it did not blow a fuse) could cause one or both 100 Ω 7 watt resistors to overheat and smoke. This could also be caused by a leaky or shorted 125 μfd output filter capacitor.

Relay chatter is generally caused by insufficient voltage across the relay coil, especially in 6.3 volt AC applications. This can be caused by low line voltage when using the UT-1 Supply. Also, avoid filament voltage drop by using a minimum length of power cable.

SERVICE

If, after applying the information contained in this manual and your best efforts on the unit, you are still unable to obtain proper performance from the Power Supply, it is suggested that you take advantage of the technical facilities which the Heath Company makes available to its customers.

The Technical Consultation Department is maintained for the purpose of providing Heath customers with a personalized technical consultation service; this service is available to you without charge. The technical consultants are thoroughly familiar with all details of the instrument and can usually localize the trouble from a suitable description of the difficulty encountered. It is, of course, necessary that you provide full and complete information concerning your problem when writing to the Technical Consultation Department for assistance. For instance, clearly identify the kit involved, giving the purchase date and, if possible, the invoice number; describe in detail the difficulty that you have encountered; state what you have attempted to do to rectify the trouble, what results have been achieved, and include any information or clues that you feel could possibly be of value to the consultant who handles your problem. Failure to provide complete descriptive details may lead to incorrect assumptions on the part of the consultant and needless delay in the solution to your problem. Quite frequently, when the information given the consultants is complete, concise and reliable, a diagnosis of the difficulty can be made with confidence and specific instructions given for its correction. If replacement of a component is involved in the correction, the component will be shipped to you, subject to the terms and conditions of the Warranty.

The Factory Service facilities are also available to you, in case you are not familiar enough with electronics to provide our consultants with sufficient information on which to base a diagnosis of your difficulty, or in the event that you prefer to have the difficulty corrected in this manner. You may return the completed Power Supply to the Heath Company for inspection and necessary repairs and adjustments. You will be charged a fixed fee of $3.00, plus the price of any additional parts or material required. However, if the completed kit is returned within the Warranty period, parts charges will be governed by the terms of the Warranty. State the date of purchase and give invoice number, if possible.

Local Service by Authorized Heathkit Dealers is also available and often will be your fastest, most efficient method of obtaining service for your Heathkits. Although you may find charges for local service somewhat higher than those listed in Heathkit manuals (for factory service), the amount of increase is usually offset by the transportation charges you will pay if you elect to return your kit to the Heath Company.

Heathkit dealers will honor the regular 90 day Heathkit Parts Warranty on all kits, whether purchased through a dealer or directly from Heath Company. It will be necessary that you verify the purchase date of your kit by presenting your copy of the Heath Company invoice to the authorized dealer involved.

Under the conditions specified in the Warranty, replacement parts are supplied without charge; however, if your local dealer assists you in locating a defective part (or parts) in your Heathkit, or installs a replacement part for you, he may charge you for this service.

Heathkits purchased locally and returned to Heath Company for service must be accompanied by your copy of the dated sales receipt from your authorized Heathkit dealer in order to be eligible for parts replacement under the terms of the Warranty.

THESE SERVICE POLICIES APPLY ONLY TO COMPLETED INSTRUMENTS CONSTRUCTED IN ACCORDANCE WITH THE INSTRUCTIONS AS STATED IN THE MANUAL. Instruments that are not entirely completed or instruments that are modified in design will not be accepted for repair. Instruments showing evidence of acid core solder or paste fluxes will be returned NOT repaired.

For information regarding modifications of Heathkits for special applications, it is suggested that you refer to any one or more of the many publications that are available on all phases of electronics. They can be obtained at or through your local library, as well as at most electronic outlet stores. Although the Heath Company welcomes all comments and suggestions, it would be impossible to design, test, evaluate and assume responsibility for proposed circuit changes for specific purposes. Therefore, such modifications must be made at the discretion of the kit builder, according to information which will be much more readily available from some local source.

REPLACEMENTS

Material supplied with Heathkits has been carefully selected to meet design requirements and ordinarily will fulfill its function without difficulty. Occasionally improper instrument operation can be traced to a faulty tube or component. Should inspection reveal the necessity for replacement, write to the Heath Company and supply all of the following information:

A. Thoroughly identify the part or parts in question by using the part number and description found in the manual Parts List.
B. Identify the type and model number of kit in which it is used.
C. Mention the order number and date of purchase.
D. Describe the nature of defect or reason for requesting replacement.

The Heath Company will promptly supply the necessary replacement. Please do not return the original component until specifically requested to do so. Do not dismantle the component in question as this will void the guarantee. If tubes are to be returned, pack them carefully to prevent breakage in shipment as broken tubes are not eligible for replacement. This replacement policy does not cover the free replacement of parts that may have been broken or damaged through carelessness on the part of the kit builder.

SHIPPING INSTRUCTIONS

In the event that your Power Supply must be returned for service, these instructions should be carefully followed.

ATTACH A TAG TO THE POWER SUPPLY BEARING YOUR NAME, COMPLETE ADDRESS, INVOICE NUMBER ON WHICH THE KIT WAS PURCHASED, AND A BRIEF DESCRIPTION OF THE DIFFICULTY ENCOUNTERED. Wrap the Power Supply in heavy paper, exercising care to prevent damage. Place the wrapped Power Supply in a stout carton of such size that at least three inches of shredded paper, excelsior, or other resilient packing material can be placed between all sides of the Power Supply and the carton. Close and seal the carton with gummed paper tape, or alternately, tie securely with stout cord. Clearly print the address on the carton as follows:

To: HEATH COMPANY
Benton Harbor, Mich.

Include your name and return address on the outside of the carton. Preferably affix one or more "Fragile" or "Handle With Care" labels to the carton, or otherwise so mark with a crayon of bright color. Ship by parcel post or prepaid express; note that a carrier cannot be held responsible for damage in transit, if in HIS OPINION, the article is inadequately packed for shipment. Your Power Supply will be returned by express collect.

SPECIFICATION CHANGES

All prices are subject to change without notice. The Heath Company reserves the right to discontinue instruments and to change specifications at any time without incurring any obligation to incorporate new features in instruments previously sold.

WARRANTY

Heath Company warrants that for a period of three months from the date of shipment, all Heathkit parts shall be free of defects in materials and workmanship under normal use and service and that in fulfillment of any breach of such warranty, Heath Company shall replace such defective parts upon the return of the same to its factory. The foregoing warranty shall apply only to the original buyer, and is and shall be in lieu of all other warranties, whether express or implied and of all other obligations or liabilities on the part of Heath Company and in no event shall Heath Company be liable for any anticipated profits, consequential damages, loss of time or other losses incurred by the buyer in connection with the purchase, assembly or operation of Heathkits or components thereof. No replacement shall be made of parts damaged by the buyer in the course of handling or assembling Heathkit equipment.

NOTE: The foregoing warranty is completely void and we will not replace, repair or service instruments or parts thereof in which acid core solder or paste fluxes have been used.

HEATH COMPANY

PARTS LIST

PART No.	PARTS Per Kit	DESCRIPTION
Resistors-Capacitors		
A-3Y-3	1	30 KΩ 25 watt wire-wound center tapped resistor
A-3G-9	2	100 Ω 7 watt wire-wound 10% resistor
B-25-34	2	125 μfd 450 V twist prong electrolytic capacitor
C-21-71	4	.001 μfd GMV 1400 V disc ceramic capacitor
C-25-36	2	40 μfd 450 V electrolytic tubular capacitor
Choke-Switch-Transformer		
D-45-17	2	Line choke
54-88	1	Power transformer
61-1	1	SPST toggle switch
Plug-Socket-Terminal Strips		
A-431-2	1	2-lug terminal strip
A-431-5	3	4-lug terminal strip
A-431-11	2	5-lug terminal strip
A-431-33	1	3-lug terminal strip
432-20	1	6-contact plug, male
432-21	2	6-contact socket, female
438-11	1	Plug, AC fused
Wire-Cord-Sleeving		
A-89-4	1	Line cord
344-1	3	Length hookup wire (1 each-black, orange, red)
346-1	1	Length insulated sleeving
346-5	2	Length 1/4" ID plastic tubing
346-6	2	Length 3/8" insulated sleeving
347-1	1	Length 8-conductor cable

PART No.	PARTS Per Kit	DESCRIPTION
Metal Parts		
200-M220F275	1	Chassis
204-M198	1	Mounting bracket
205-M168F	1	Bottom plate
Hardware		
250-8	8	#6 x 3/8" BH sheet metal screw
250-18	7	8-32 x 3/8" RHMS
250-56	10	6-32 x 1/4" BHMS
250-123	1	10-24 x 2 1/4" slotted hex head screw
252-3	10	6-32 x 1/4" nut
252-4	11	8-32 x 3/8" nut
252-30	1	10-24 hex nut
253-7	1	#10 fiber shoulder washer
253-42	3	1/2" x 3/16" flat washer
254-1	10	#6 lockwasher
254-2	11	#8 lockwasher
255-13	4	1/4" spacer
Miscellaneous		
57-20	4	Silicon rectifier (500 ma)
73-1	1	3/8" x 9/32" rubber grommet
73-4	1	3/16" x 5/16" rubber grommet
90-101	1	Cabinet cover
261-6	4	Rubber foot
390-77	1	Adhesive label, output terminal connections
391-7	1	Heathkit nameplate, black (silver center)
412-10	1	Neon pilot light
421-2	4	3 amp fuse (2 spare)
481-3	2	Capacitor mounting wafer (fiber)
595-271	1	Manual

6-32 x 1/4" BHMS
250-56

#6 LOCKWASHER
254-1

6-32 NUT
252-3

1/4" SPACER
255-13

8-32 x 3/8" RHMS
250-18

#8 LOCKWASHER
254-2

8-32 NUT
252-4

3/16" x 5/16"
RUBBER GROMMET
73-4

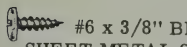
10-24 x 2 1/4"
SLOTTED HEX
HEAD SCREW
250-123

1/2" x 3/16" WASHER
253-42

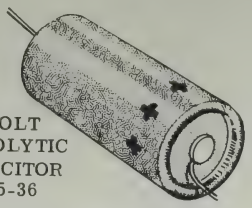
#10 FIBER
(SHOULDER) WASHER
253-7

10-24 NUT
252-30

3/8" x 9/32"
RUBBER GROMMET
73-1

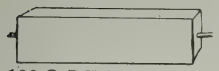


#6 x 3/8" BH
SHEET METAL SCREW
250-8



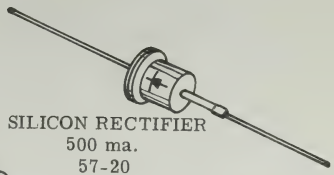
40 μfd 450 VOLT
ELECTROLYTIC
CAPACITOR
C-25-36

.001 μfd 1400 VOLT
DISC CERAMIC
CAPACITOR
C-21-71

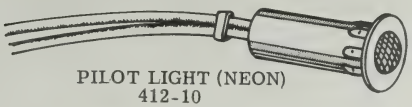


100 Ω 7 WATT RESISTOR
A-3G-9

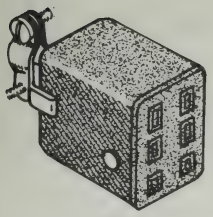
LINE CHOKE
D-45-17



SILICON RECTIFIER
500 ma.
57-20

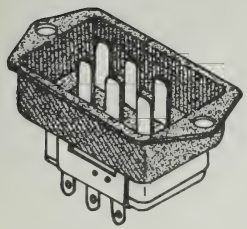


PILOT LIGHT (NEON)
412-10



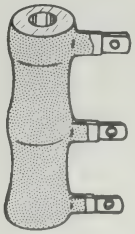
FEMALE
6 CONTACT SOCKET
432-21

RUBBER FOOT
261-6

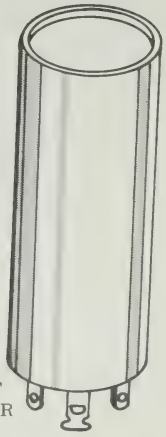


MALE
6 CONTACT PLUG
432-20

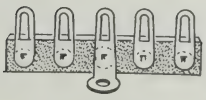
3/8 FIBER
GLASS SLEEVING
346-6



30 KΩ 25 WATT
BLEEDER RESISTOR
3Y-3



125 μfd 450 VOLT
ELECTROLYTIC CAPACITOR
B-25-34

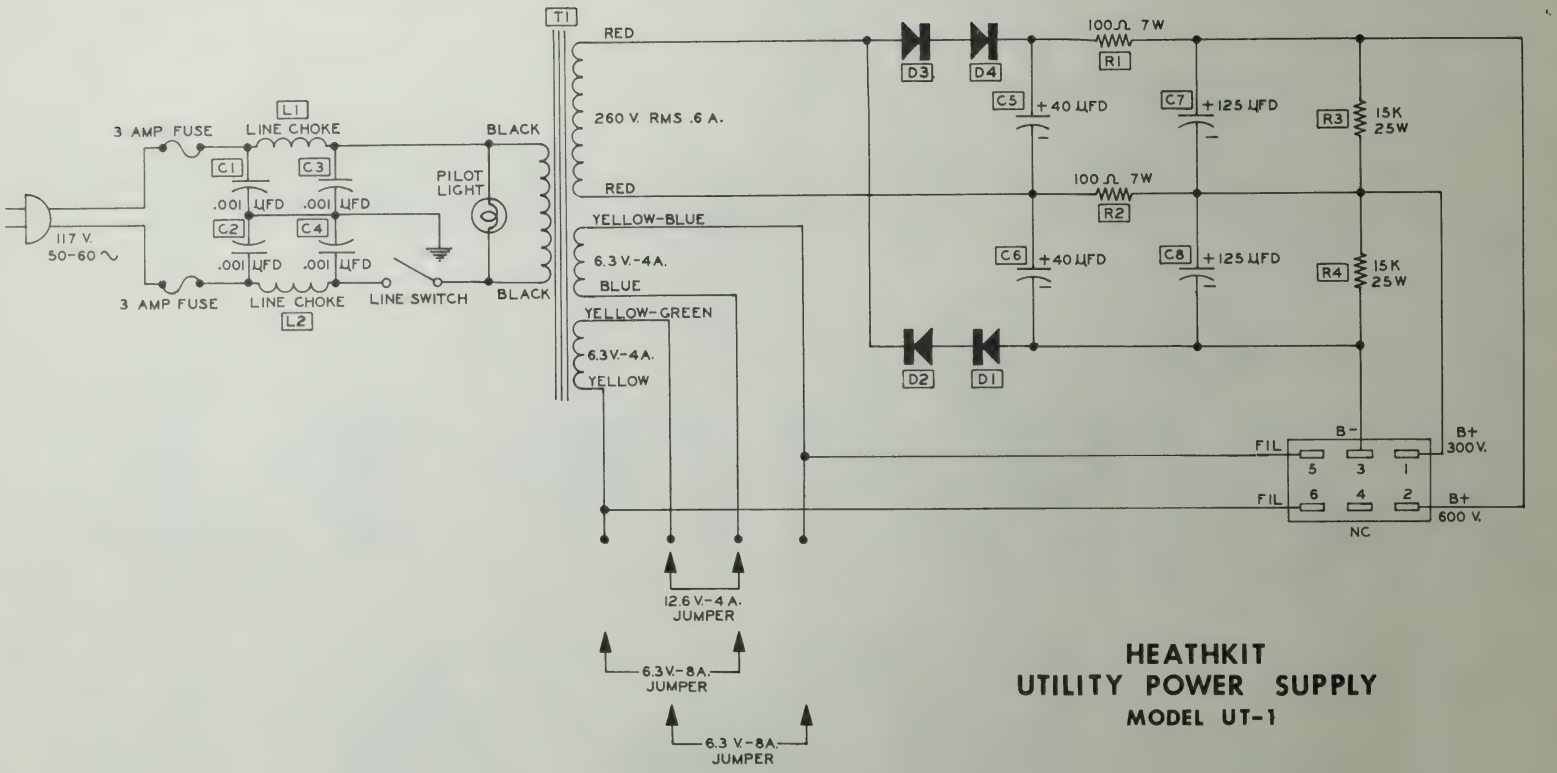


5-LUG
TERMINAL STRIP
A-431-11

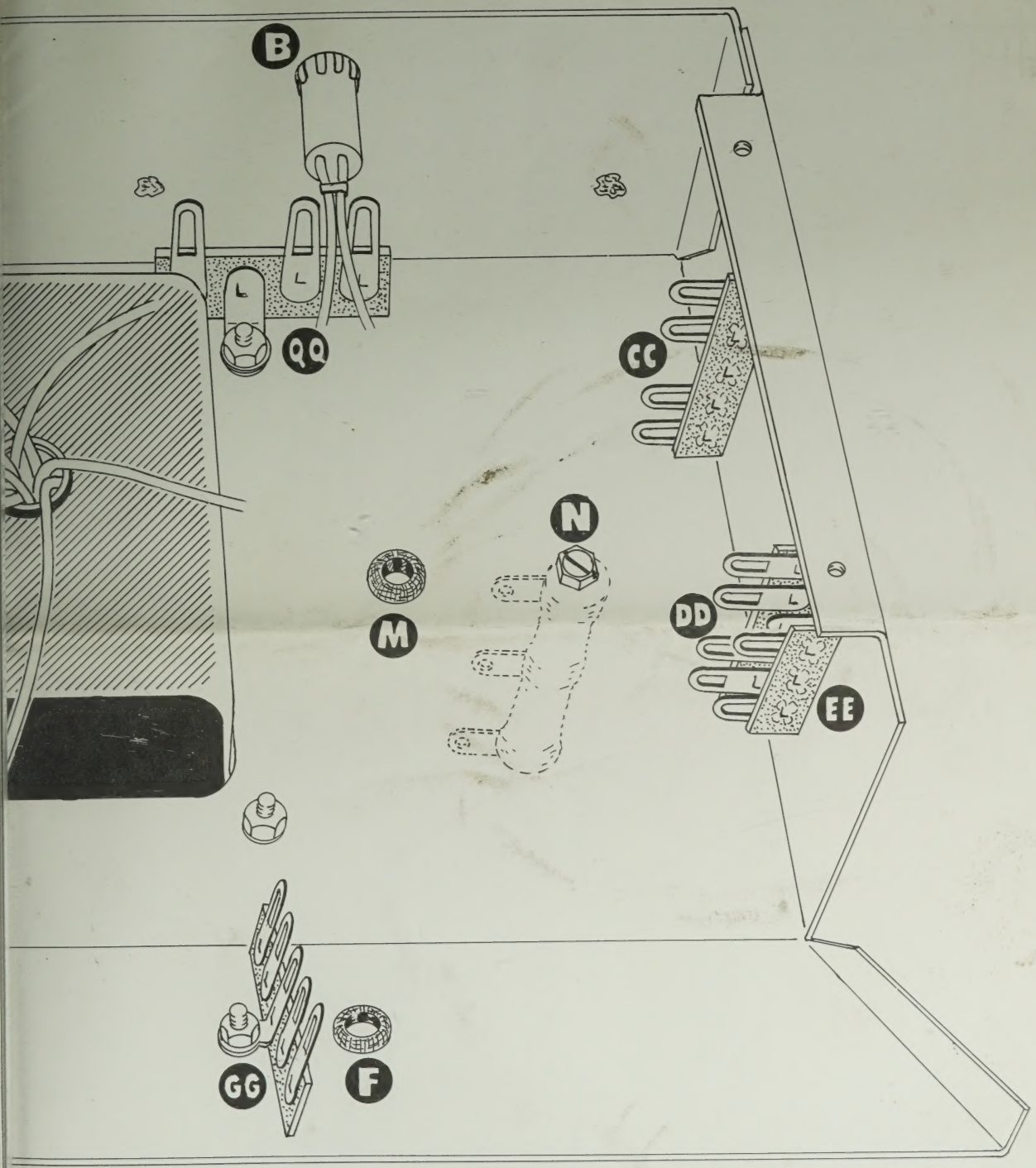
4-LUG
TERMINAL STRIP
A-431-5

3-LUG
TERMINAL STRIP
#8 Foot A-431-33

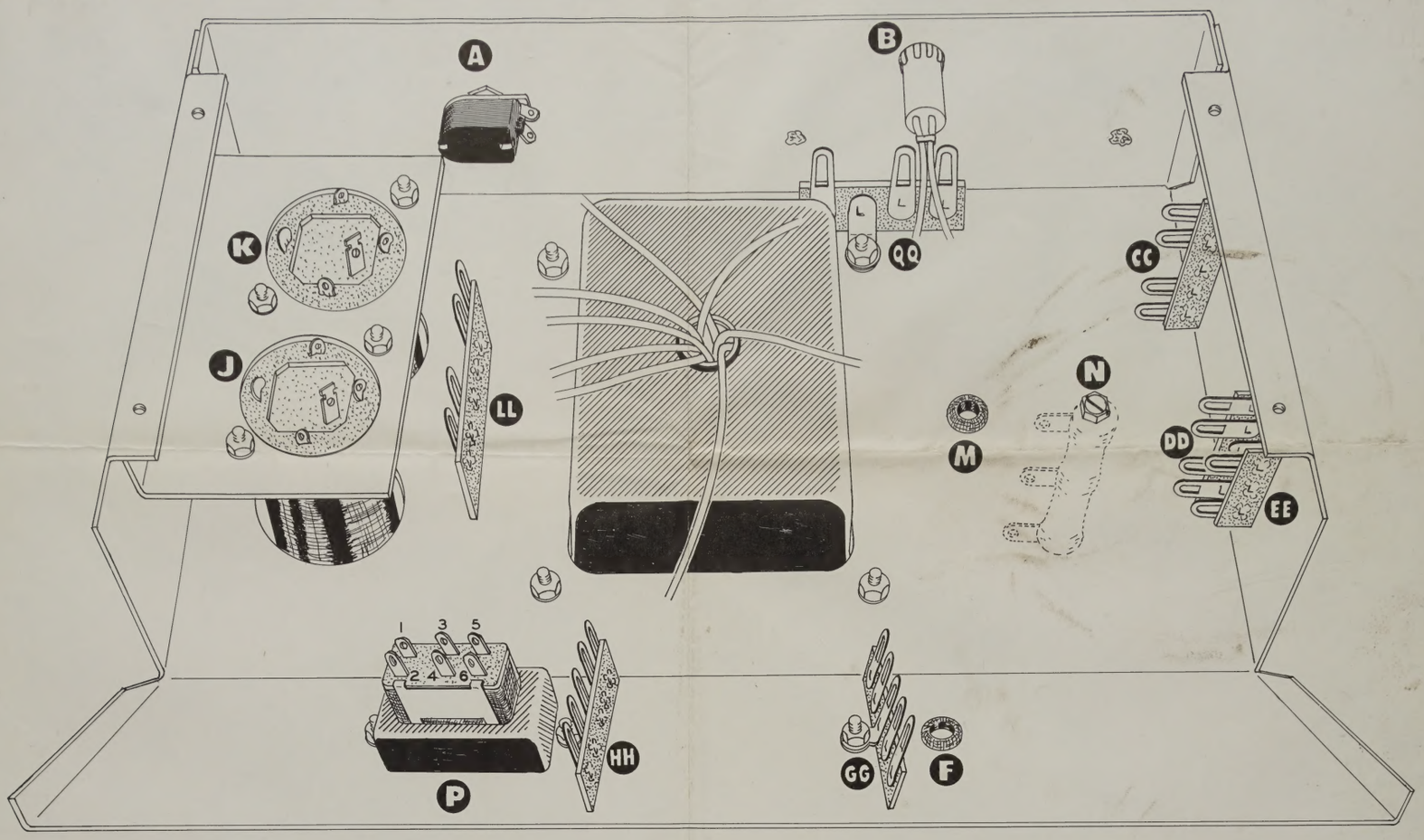
2-LUG
TERMINAL STRIP
A-431-2



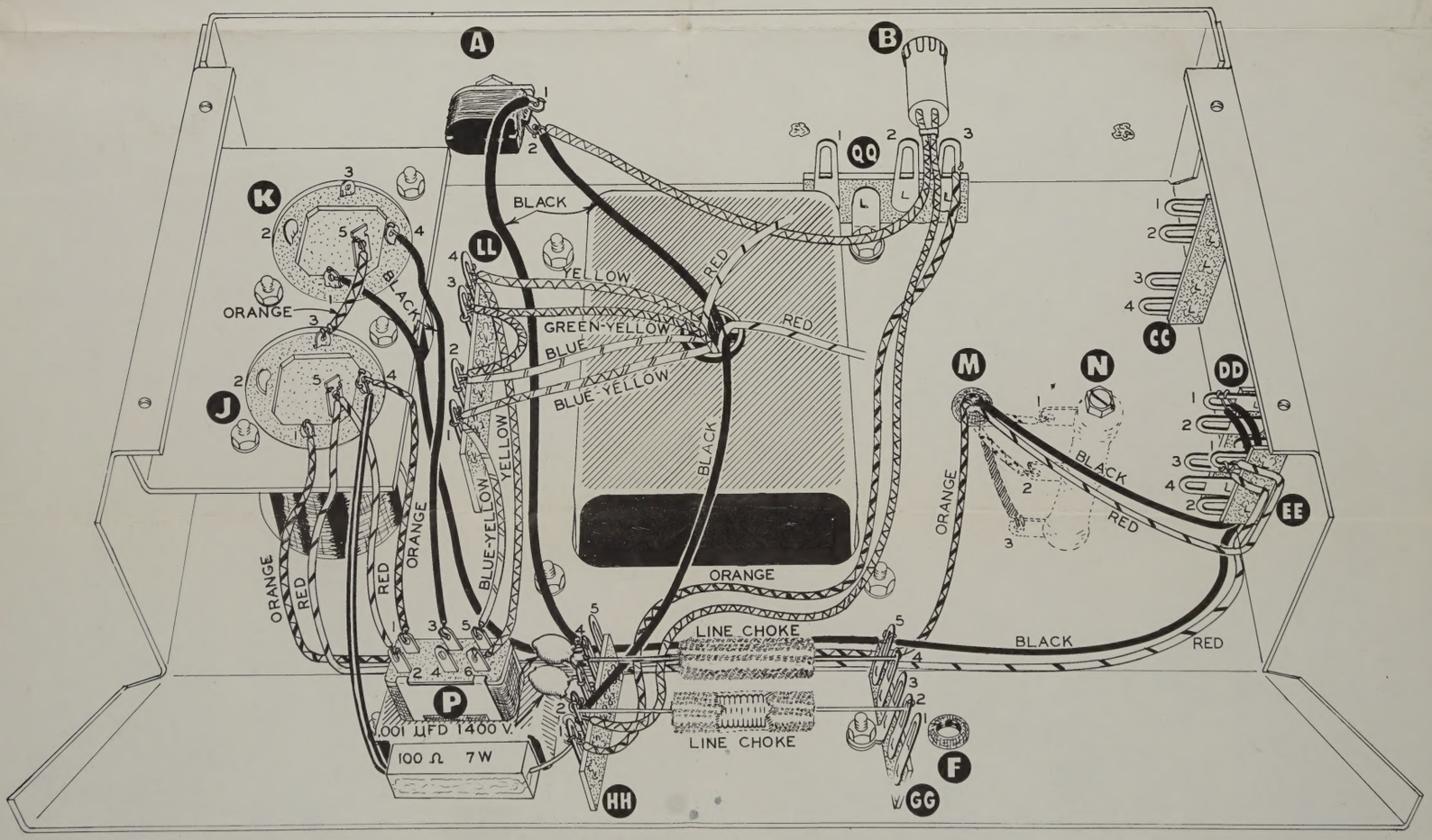
HEATHKIT
UTILITY POWER SUPPLY
MODEL UT-1



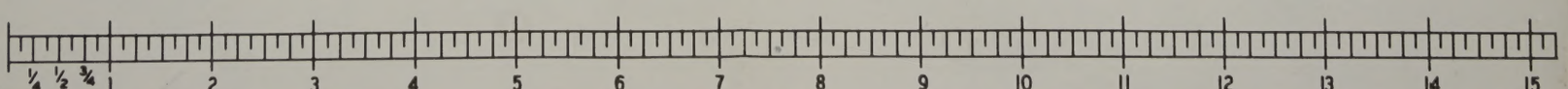
Pictorial 1



Pictorial 1



Pictorial 3



HELPFUL KIT BUILDING INFORMATION

Before attempting actual kit construction read the construction manual through thoroughly to familiarize yourself with the general procedure. Note the relative location of pictorials and pictorial inserts in respect to the progress of the assembly procedure outlined.

This information is offered primarily for the convenience of novice kit builders and will be of definite assistance to those lacking thorough knowledge of good construction practices. Even the advanced electronics enthusiast may benefit by a brief review of this material before proceeding with kit construction. In the majority of cases, failure to observe basic instruction fundamentals is responsible for inability to obtain desired level of performance.

RECOMMENDED TOOLS

The successful construction of Heathkits does not require the use of specialized equipment and only basic tools are required. A good quality electric soldering iron is essential. The preferred size would be a 100 watt iron with a small tip. The use of long nose pliers and diagonal or side cutting pliers is recommended. A small screw driver will prove adequate and several additional assorted screw drivers will be helpful. Be sure to obtain a good supply of rosin core type radio solder. Never use separate fluxes, paste or acid solder in electronic work.

ASSEMBLY

In the actual mechanical assembly of components to the chassis and panel, it is important that the procedure shown in the manual be carefully followed. Make sure that tube sockets are properly mounted in respect to keyway or pin numbering location. The same applies to transformer mountings so that the correct transformer color coded wires will be available at the proper chassis opening.

Make it a standard practice to use lock washers under all 6-32 and 8-32 nuts. The only exception being in the use of solder lugs—the necessary locking feature is already incorporated in the design of the solder lugs. A control lock washer should always be used between the control and the chassis to prevent undesirable rotation in the panel. To improve instrument appearance and to prevent possible panel marring use a control flat nickel washer under each control nut.

When installing binding posts that require the use of fiber insulating washers, it is good practice to slip the shoulder washer over the binding post mounting stud before installing the mounting stud in the panel hole provided. Next, install a flat fiber washer and a solder lug under the mounting nut. Be sure that the shoulder washer is properly centered in the panel to prevent possible shorting of the binding post.

WIRING

When following wiring procedure make the leads as short and direct as possible. In filament wiring requiring the use of a twisted pair of wires allow sufficient slack in the wiring that will permit the twisted pair to be pushed against the chassis as closely as possible thereby affording relative isolation from adjacent parts and wiring.

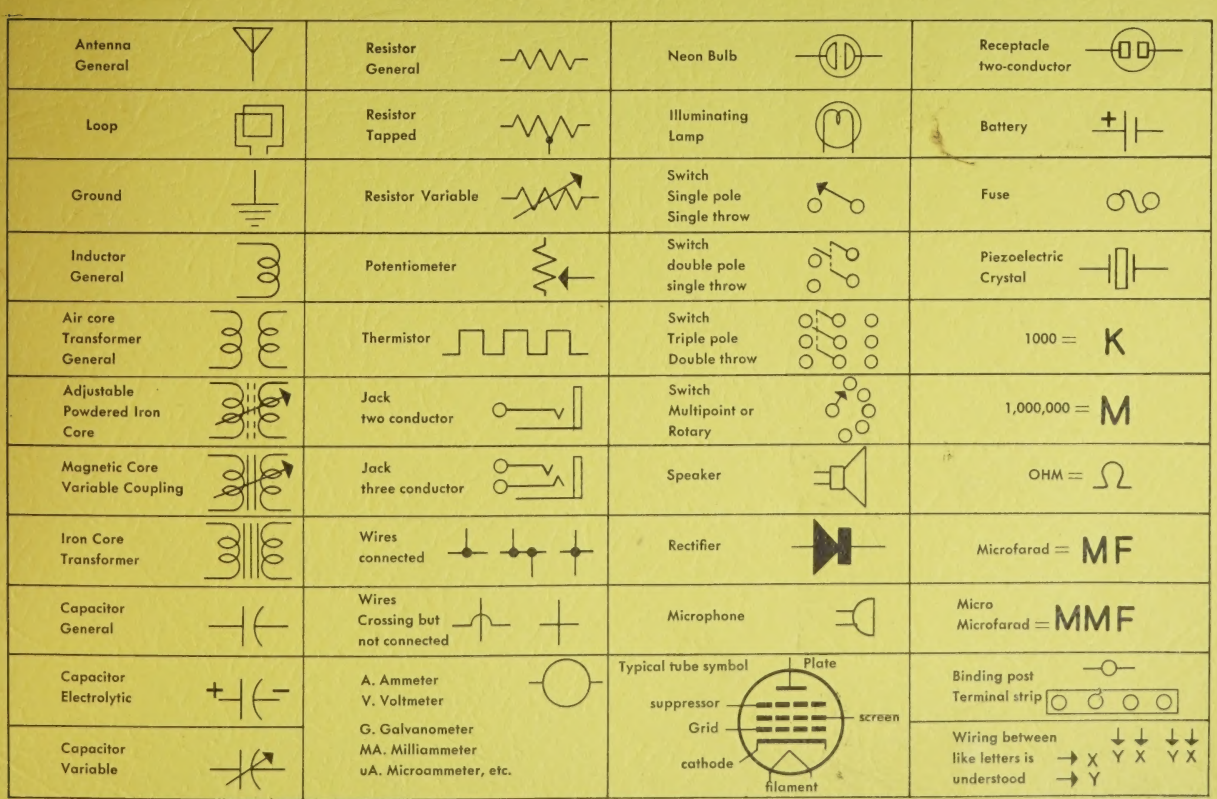
When removing insulation from the end of hookup wire, it is seldom necessary to expose more than a quarter inch of the wire. Excessive insulation removal may cause a short circuit condition in respect to nearby wiring or terminals. In some instances, transformer leads of solid copper will have a brown baked enamel coating. After the transformer leads have been trimmed to a suitable length, it is necessary to scrape the enamel coating in order to expose the bright copper wire before making a terminal or soldered connection.

In mounting parts such as resistors or condensers, trim off all excess lead lengths so that the parts may be installed in a direct point-to-point manner. When necessary use spaghetti or insulated sleeving over exposed wires that might short to nearby wiring.

It is urgently recommended that the wiring dress and parts layout as shown in the construction manual be faithfully followed. In every instance, the desirability of this arrangement was carefully determined through the construction of a series of laboratory models.

SOLDERING

Much of the performance of the kit instrument, particularly in respect to accuracy and stability, depends upon the degree of workmanship used in making soldered connections. Proper soldered connections are not at all difficult to make but it would be advisable to observe a few precautions. First of all before a connection is to be soldered, the connection itself should be clean and mechanically strong. Do not depend on solder alone to hold a connection together. The tip of the soldering iron should be bright, clean and free of excess solder. Use enough heat to thoroughly flow the solder smoothly into the joint. Avoid excessive use of solder and do not allow a flux flooding condition to occur which could conceivably cause a leakage path between adjacent terminals on switch assemblies and tube sockets. This is particularly important in instruments such as the VTVM, oscilloscope and generator kits. Excessive heat will also burn or damage the insulating material used in the manufacture of switch assemblies. Be sure to use only good quality rosin core radio type solder.



Courtesy of I. R. E.

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